



Goose Creek Water Quality Monitoring Report

March 2006



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Technical Report #: GC06

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Introduction

In 2001, the West Cassia Soil and Water Conservation District (SWCD) expressed interest to the Idaho Association of Soil Conservation Districts (IASCD) in collecting information on water quality in the Goose Creek drainage on streams impacted by agricultural activities. Prior to construction of Oakley Dam, Goose Creek was a tributary of the Snake River, entering the river near Burley. Since the construction of the dam in 1915 all of the water is stored in Lower Goose Creek Reservoir and diverted for irrigation. Flow in the historical stream channel between Oakley and the Snake River does not exist and most of the channel has been filled in or developed. Birch Creek and Trapper Creek are tributaries of Goose Creek. Birch Creek presently is diverted for irrigation and never reaches the historic Goose Creek channel near Oakley. Trapper Creek empties into Lower Goose Creek Reservoir 2-3 miles upstream of the dam.

The Goose Creek TMDL was completed in November 2003. Tributaries included on the state of Idaho 303(d) list are specifically addressed in the Goose Creek TMDL, including Goose Creek, Trapper Creek and Birch Creek. The three stream segments are TMDL listed as follows: Goose Creek for bedload sediment; Birch Creek for total phosphorous and bacteria; and Trapper Creek for total phosphorous and bedload sediment.

Monitoring Program

IASCD selected a total of six monitoring sites on Goose Creek, Birch Creek and Trapper Creek to collect the data prior to the development of the Goose Creek Total Maximum Daily Load (TMDL) (Figure 1). An additional site was added on Trapper Creek midway through the two years of data collection, for a total of seven sites. Sampling began in November of 2001 and continued through October of 2003. IASCD collected water quality samples twice per month beginning in November 2001 through October

2003. During the winter months (November – January) monthly samples were collected at each site. In February 2003, water quality monitoring began on TC2 and continued through October 2003. The seven monitoring sites are shown in Table 1.

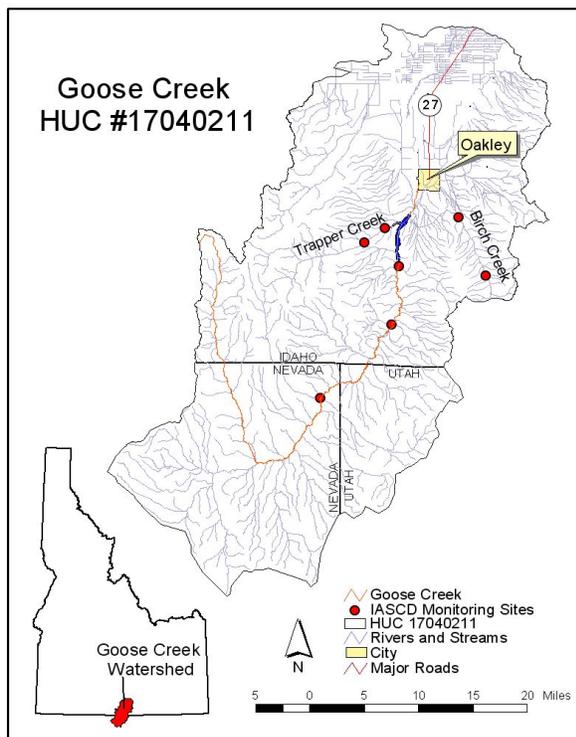


Figure 1. Monitoring site locations.

Table 1. Monitoring Site Descriptions.

Site	Description
GC1	Goose Creek at USGS gage
GC2	Goose Creek 6 ½ miles upstream Goose Creek Res.
GC3	Goose Creek 2 miles upstream of Utah/Idaho border
BC1	Birch Creek @ USGS gage
BC2	Birch Creek above Walters Ck
TC1	Trapper Creek near mouth of Lower Goose Creek Res.
TC2	1 mile above USGS gage

Samples were collected at all sites for total suspended solids (TSS), total volatile solids (TVS), total phosphorous (TP), ortho phosphorous (OP) and *Escherichia Coli* (*E. coli*). The original sampling plan included sampling for nitrogen (nitrate/nitrite), nitrogen ammonia and total Kjeldahl nitrogen. Over the

course of the project, sampling for nitrate, nitrite and total Kjeldahl nitrogen was discontinued due to low testing results.

Field measurements were made during each site visit for dissolved oxygen, water temperature, specific conductance, total dissolved solids, pH and stream discharge.

Results

Stream Discharge (Q)

Stream discharge on all three creeks fluctuated seasonally. Stream discharge was greatest during spring months and had low base flow during the rest of the year. Goose Creek, being the main water body in the HUC, had the greatest stream discharge of the creeks monitored. Birch Creek at BC2 was the only stream that dried up during the late summer months of 2003. Stream discharge at Goose Creek was significantly greater than in Birch Creek and Trapper Creek ($p > 0.0001$) (Figure 2). Stream discharge was not significantly different between each of the sites on Goose Creek ($p > 0.37$). Birch Creek and Trapper Creek did have a significant difference in stream discharge from the upper sites to the lower sites ($p > 0.0001$ and $p > 0.01$ respectively). Mean, minimum, maximum and standard deviation for stream discharge at each site is shown in Table 2.

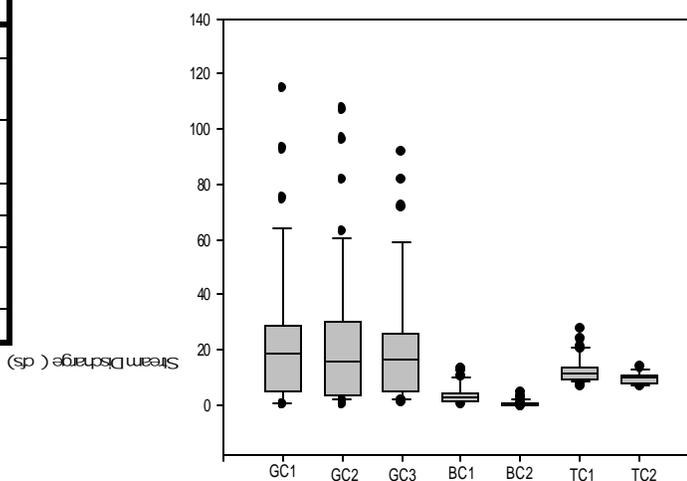


Figure 2. Stream discharge (cfs) on Yaxis.

Table 2. Stream discharge (cfs) statistics.

Site	Mean (cfs)	Min (cfs)	Max (cfs)	Std. Dev.
GC1	24.53	0.10	115.00	26.83
GC2	23.83	0.20	107.30	25.92
GC3	22.15	1.05	91.83	22.59
BC1	3.75	0.61	12.88	3.28
BC2	0.63	0.05	4.44	0.91
TC1	12.32	6.98	27.59	4.60
TC2	9.67	6.86	13.75	2.00

Std. Dev.: standard deviation

Total Suspended Sediment (TSS)

Total suspended sediment concentration standards for all three study segments set by the Goose Creek TMDL are 80 mg/L instantaneously. Goose Creek at GC1 and GC2 were the only sites where TSS concentrations exceeded the TMDL target for more than 10% of the samples (14% and 11% respectively). All of the exceedances at these sites occurred during high spring flows in the spring of 2002. A logarithmic sediment rating curve shows the relationship between stream discharge sediment concentrations (Figure 3). As stream discharge increased above approximately 60 cfs sediment concentrations exceeded the instantaneous TMDL limit at GC1 and GC2. At GC3 TSS concentrations did not exceed the TMDL target until stream discharge was approximately greater than 90 cfs. There was one exceedance for TSS on Birch Creek at BC2 where levels reached 132 mg/L in the late fall. TSS concentrations did not correlate with stream discharge at this site. This is most likely due to cattle grazing at this site during late fall months and lack of flow during summer months. The exceedances on Trapper Creek also occurred during spring runoff events in both 2002 and 2003. There were only three exceedances at TC1 and one exceedance at TC2. TSS concentrations did not correlate with stream discharge at TC2. This lack of correlation at TC2 is probably the result of fewer data points and land use practices. Mean, minimum, maximum and the standard deviation for TSS concentration data is shown in Table 3.

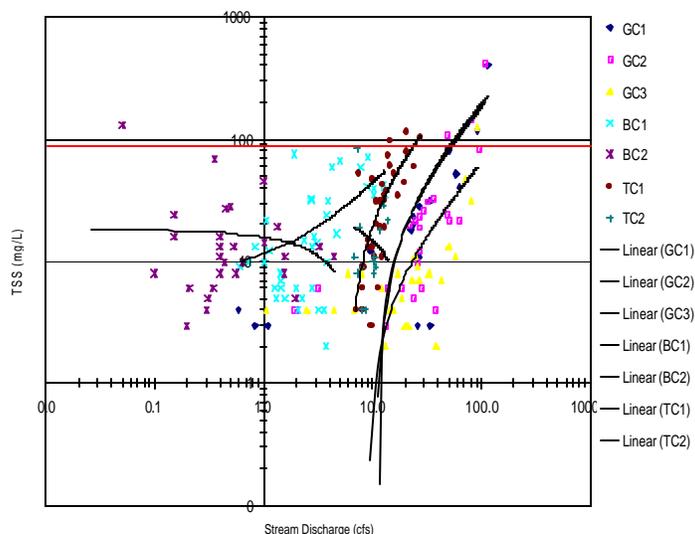


Figure 3. Logarithmic sediment rating curve for Goose Creek, Birch Creek and Trapper Creek. The 80 mg/L target is shown in red.

Table 3. Total suspended sediment (mg/L) statistics.

Site	Mean TSS (mg/L)	Min TSS (mg/L)	Max TSS (mg/L)	Std. Dev.
GC1	30.64	<2	403	70.9
GC2	27.6	<2	423	70.8
GC3	10.11	<2	125	21.3
BC1	21.95	<2	75	20.7
BC2	17.16	<2	132	24.9
TC1	31.28	<2	115	30.4
TC2	16.25	<2	84	19.4

Total Phosphorous (TP)

The Goose Creek TMDL established TP limits on Goose Creek and Trapper Creek at 0.08 mg/L as a daily maximum. The TP limit on Birch Creek was set at 0.16 mg/L for a daily maximum. The TP target on Goose Creek was exceeded for more than 10% of the samples at all three sites. This target was also exceeded for more than 10% of the samples at TC1. TP targets were only exceeded for one sampling period at TC2 and at both sites on Birch Creek. The exceedances of TP concentrations on Goose Creek generally occurred during spring runoff events. There were, however, exceedances that

occurred during late summer months most likely associated with cattle grazing. Total phosphorous means, minimums, maximums and standard deviation data are shown in Table 4.

Total phosphorous levels at Goose Creek were made up of more than 50% dissolved phosphorous. The concentration of dissolved phosphorous increased at each site from upstream to downstream (Figure 4). Dissolved phosphorous levels in Birch Creek and Trapper Creek remained close to 50% of the total phosphorous. Dissolved phosphorous levels increased during spring runoff at all the sites. This is most likely due to overland flow across pastures and grazed lands.

Table 4. Total phosphorous (mg/L) statistics.

Site	Mean TP (mg/L)	Min TP (mg/L)	Max TP (mg/L)	Std. Dev.
GC1	0.068	0.019	0.18	0.04
GC2	0.062	0.017	0.14	0.03
GC3	0.053	0.017	0.14	0.027
BC1	0.084	0.046	0.18	0.032
BC2	0.069	0.032	0.22	0.041
TC1	0.075	0.024	0.19	0.043
TC2	0.049	0.023	0.13	0.026

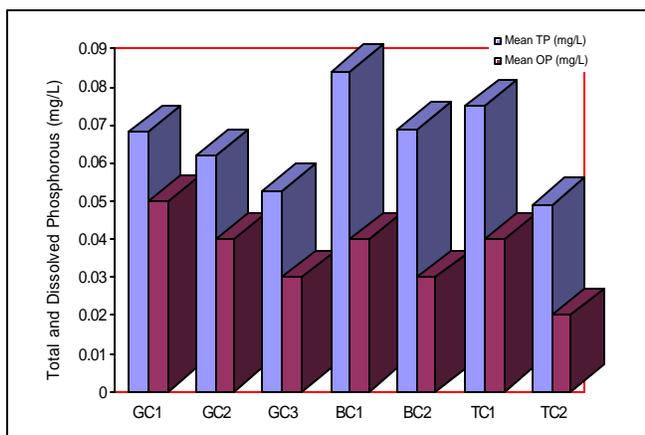


Figure 4. Total and orthophosphorous levels (mg/L) in the Goose Creek watershed.

Bacteria (*E. Coli*)

Bacteria limits on the Goose Creek watershed are set at 576 cfu/100mL for secondary contact recreation. GC3 was the only site on Goose Creek where *E. coli* targets were exceeded

which occurred in late fall 2003. Trapper Creek at both sites also had less than 10% exceedances for bacteria. *E. coli* targets at BC1 were exceeded for more than 10% of the samples with most of the exceedances occurring in the late fall. The target for bacteria was also exceeded at BC2 less than 10% of the samples during mid-summer months. Birch Creek is the only stream listed on the 303(d) list for bacteria. The data collected by the IASCD coincided with DEQ data for bacteria.

Dissolved Oxygen (DO)

Water designated for cold water biota within the state must have DO levels exceeding 6 mg/L at all times. Goose Creek had a few days in July and August 2003 where DO was less than 6 mg/L. Stream discharge was less than 2.3 cfs during this time period and stream temperatures ranged from 16.1 °C to 21.4 °C. All three Goose Creek sites had excessive algal and macrophyte growth in nearly stagnant pools during July and August of 2003. Birch Creek and Trapper Creek did not have any sampling events where DO levels were less than 6 mg/L.

Temperature

Goose Creek is the only stream out of the three sampled streams to be listed for temperature on the 303(d) list. The temperature target for Goose Creek and its tributaries is <22 °C for cold water aquatic biota (CWAB). Birch Creek did not have any days that exceeded the temperature target. The lower site (GC1) on Goose Creek had one temperature exceedance during the late summer (Figure 5). Temperature targets were exceeded at the upper site (GC3) on two occasions, in early summer and again in the late summer. Most of the exceedances for temperature occurred on Trapper Creek. At TC1 there were three exceedances, all during late summer, and one exceedance at TC2 in July.

The temperature exceedances on Goose Creek generally occurred while flow was very low (<0.3 cfs). The exceedances at Trapper Creek occurred while flow levels were relatively higher (>7 cfs). Canopy cover should be monitored on both streams to determine the

natural background levels for stream temperature.

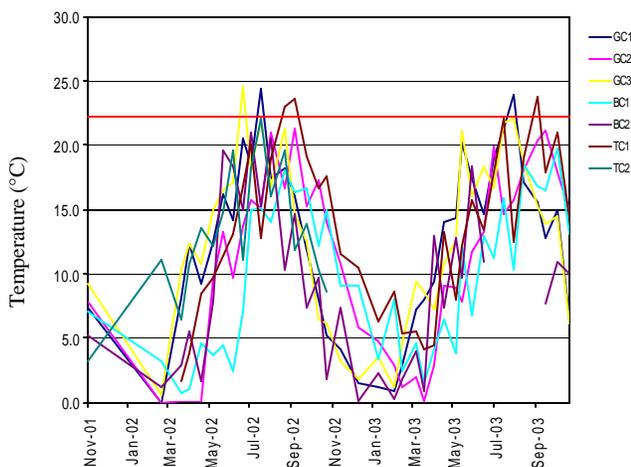


Figure 5. Stream temperature (°C) for each site in the Goose Creek watershed. The TMDL target (22°C) is in red.

Conclusion and Recommendations

Suspended sediment generally increased with stream discharge at all of the sites. There was only one instance on Birch Creek where TSS levels increased dramatically while flows remained very low. Livestock were observed at this site on this occasion. Overall, TSS levels were relatively low at all of the monitoring sites. Total phosphorous levels exceeded the TMDL target of 0.08 mg/L for more than 10% of the samples on Goose Creek. The bulk of the TP is comprised of dissolved phosphorous at the two lower sites (GC1 and GC2). The source of dissolved phosphorus is probably from the natural geology in this area with some influences from land use practices. Birch Creek and Trapper Creek did not exceed TP targets for more than 10% of the samples during this study. Birch Creek was the only stream to be listed on the 303(d) list for limited water quality due to bacteria and bacteria limits were exceeded for more than 10% of the samples at the lower Birch Creek site. Bacteria levels on Trapper Creek and Goose Creek remained relatively low throughout the sample period. Dissolved oxygen does not appear to be a problem at Trapper Creek and Birch Creek. However when flow is virtually non-existent on Goose Creek

DO levels did drop below the 6 mg/L target. Stream temperature did exceed the CWAB standard on Goose Creek when stream flow was very low. The temperature target was also exceeded on Trapper Creek; however lack of shade cover rather than lack of flow is likely the cause.

Continued sampling along these creeks to pinpoint pollution sources is recommended. Elevated bacteria levels are consistent with the grazing season in this area (May through October) and only appear to be problematic on Birch Creek. Riparian assessments were conducted on all three streams during the summer of 2005. These assessments should be used to determine optimal locations for best management practices to reduce pollutants in these streams.

Acknowledgements

Thanks to Mark Dallon who collected the data for Goose Creek and its tributaries. Technical support and suggestions were provided by Kirk Campbell and Gary Bahr of the Idaho State Department of Agriculture and Clyde Lay of the Idaho Department of Environmental Quality. Thanks to Robert Manning for allowing access to his property to sample on Birch Creek.

References

- Dallon, M. V., 2001. Goose Creek Water Quality Monitoring Plan. Idaho Association of Soil Conservation Districts.
- Lay, C.H., 2003. Goose Creek Subbasin Assessment and Total maximum Daily Loads, Draft. Idaho Division of Environmental Quality.